

# Internet of Things

## Semantic Interoperability



**Jaime Jiménez**  
Co-chair, CoRE WG (IETF)  
Chair IPSO Semantic WG (IPSO)  
Ericsson Research





“The Internet Engineering Task Force is a loosely self-organized group of people who contribute to the engineering and evolution of Internet technologies.

It is the principal body engaged in the development of new Internet standard specifications.” (RFC 4677)

[\[Docs\]](#) [\[txt|pdf\]](#) [\[draft-ietf-core-coap\]](#) [\[Diff1\]](#) [\[Diff2\]](#)

PROPOSED STANDARD

Internet Engineering Task Force (IETF)  
Request for Comments: 7252  
Category: Standards Track  
ISSN: 2070-1721

Z. Shelby  
ARM  
K. Hartke  
C. Bormann  
Universitaet Bremen TZI  
June 2014

## The Constrained Application Protocol (CoAP)

### Abstract

The Constrained Application Protocol (CoAP) is a specialized web transfer protocol for use with constrained nodes and constrained (e.g., low-power, lossy) networks. The nodes often have 8-bit microcontrollers with small amounts of ROM and RAM, while constrained networks such as IPv6 over Low-Power Wireless Personal Area Networks (6LoWPANs) often have high packet error rates and a typical throughput of 10s of kbit/s. The protocol is designed for machine-to-machine (M2M) applications such as smart energy and building



“The mission of the IETF is to make the Internet work better by producing high quality, relevant technical documents that influence the way people design, use, and manage the Internet.”

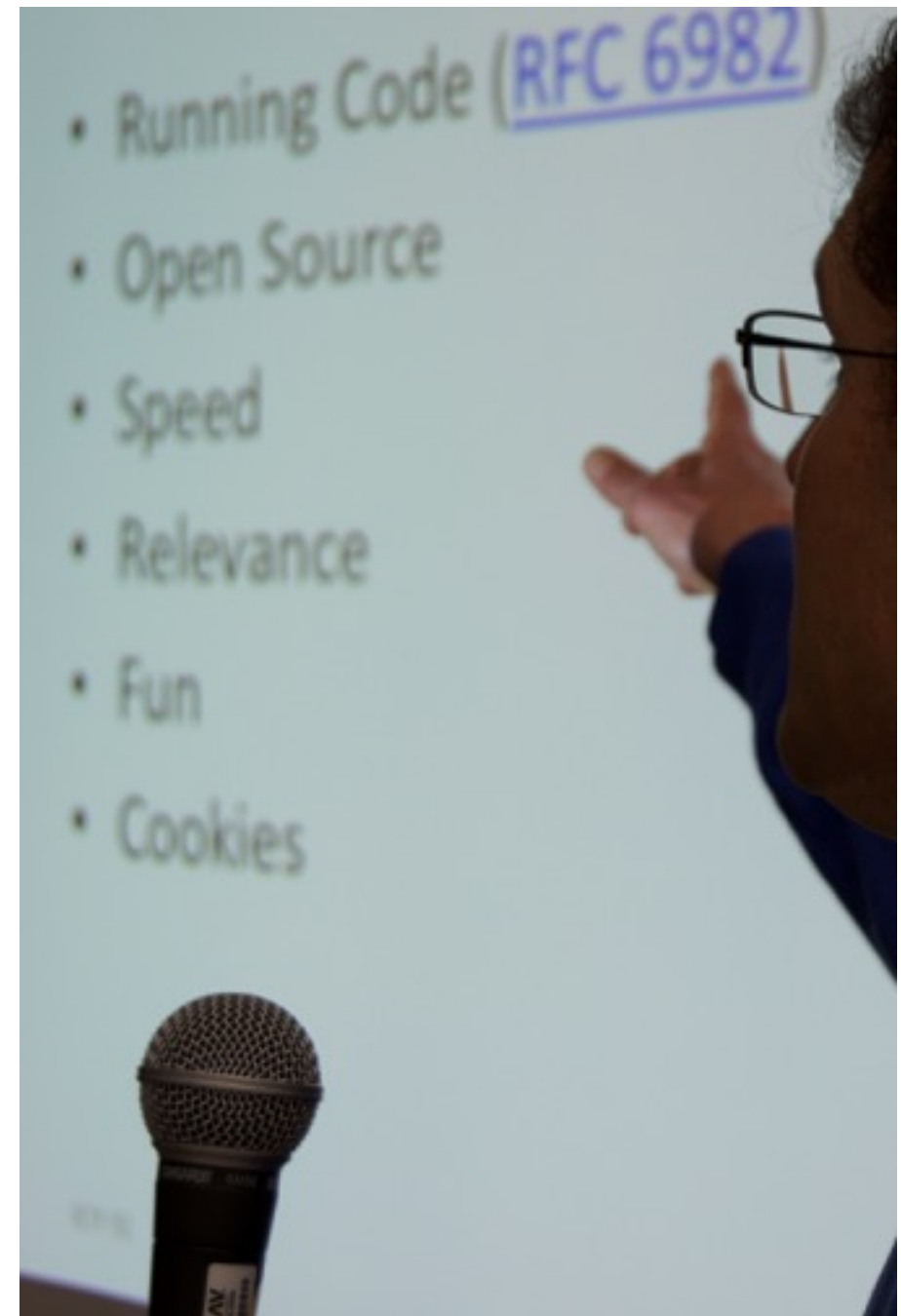
(RFC 3935)



# Some Recent Areas of Work



- Web protocols (HTTP2)
- Security and privacy (RFC7258, UTA, TLS1.3)
- Enabling real-time communications from browsers (WebRTC)
- Management, orchestration, virtualisation, and data-model driven networking (NVO, SFC, YANG)
- Internet of Things
- Running code and open source



# IETF and IoT Work



- Our role: Specify the underlying, fundamental Internet technologies
- “Permissionless innovation” — others can build on top

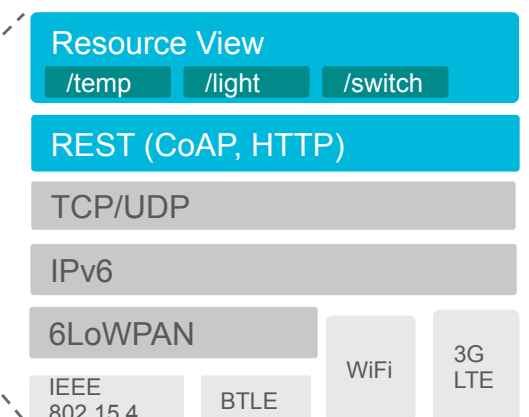
Run <IoT transfer protocol> over IP	Security for IoT (ACE, COSE)
Routing for lossy & low power networks	Thing-to-Thing communication (IRTF)
Web technology for IoT (CoRE)	Architectural oversight (IAB)

# Some Observations



- A shift from closed, vertical solutions to open, general networking solutions (IP, IPv6, mobile networks, WLAN, web)
- Consolidation moving up the stack. Already happening on transfer protocols (HTTP, CoAP, MQTT).

- A shift from devices to thinking about systems, connections between systems, analytics, etc.

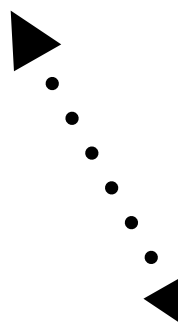
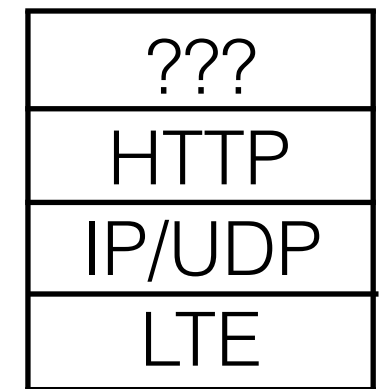
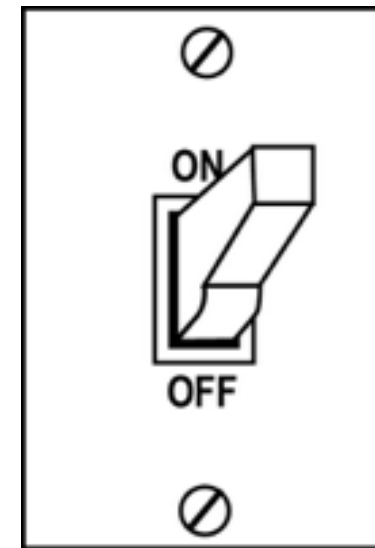


- Security continues to be a big challenge. Privacy is even a bigger one; can you choose what cloud a gadget sends data to?
- Device Management, interoperability, and updatability

# The IAB Workshop on IoT Semantic Interoperability (IoT SI)



- Most systems run on standard L2, on IP, and on top of the web protocols
- Good interoperability from a network perspective
- But is there application-level interoperability?
- Different applications, different data models across the industry





- Workshop goals: facilitate interaction, discuss how to interop/map, identify collaboration opportunities.
- 66 submissions (42 accepted)  
From 17 standards organisations, and vendors, operators, individuals and research organizations
- Several meetings co-located and many joint meetings
- Public mailing list open and a report in the works





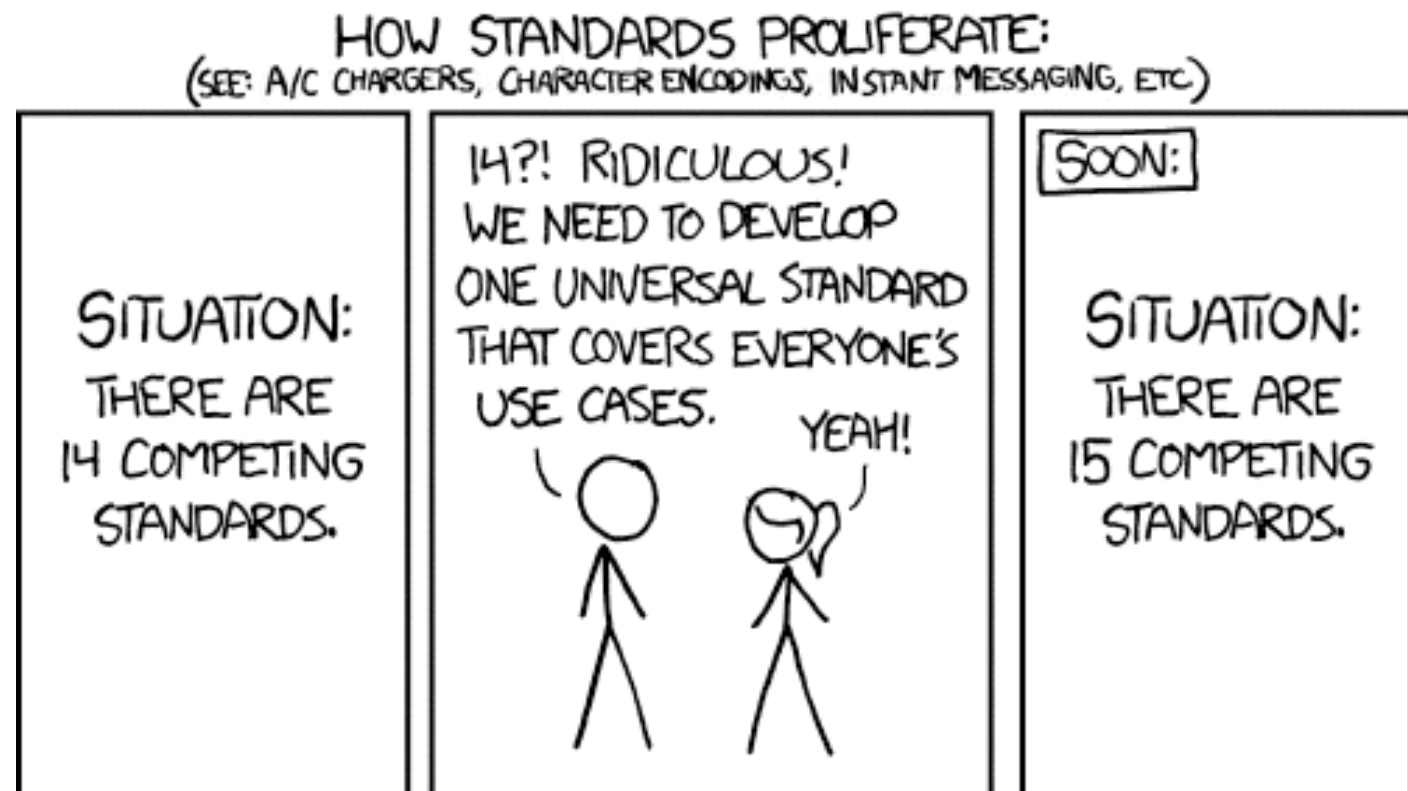


AllSeen Hub OSS IPSO Schema.org OpenDOF W3C

AIOTI IAB IoTDB OGC OMA ZigBee

ETSI IETF/IRTF NIST OIC/OCF W3C ZWave

Goal was not to  
make a new  
standard





# Some of the topics

- Meta-models and higher abstraction layers.
- Interaction models (REST, Pub/Sub, RPC).
- Simple/general vs. specific/expressive tradeoff.
- Modularity and reuse, finding the atomic components.
- Runtime Discovery vs Predefined APIs and pushing code .
- Usefulness of code generation for developers.



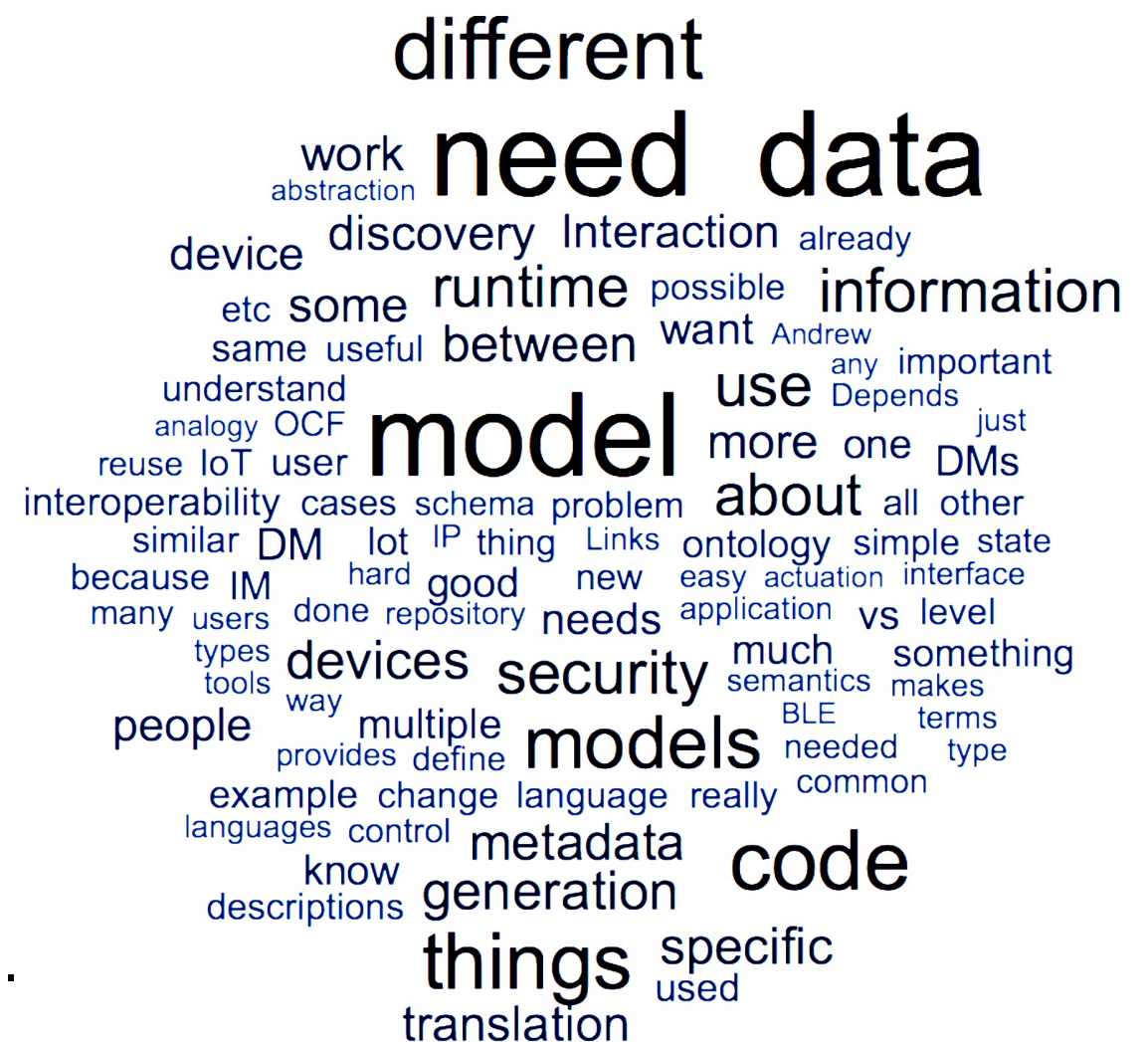
# Some of the topics II

- Runtime translation of data vs Translating DMs
- "Translation Hub/s" and how to implement it/them.
- Translation is easier if there is REST.
- "Loss" in translation from more to less expressive models
- Multiprotocol not an option for constrained devices.



# Final Thoughts

- There is agreement on the need for interoperability on IoT.
- Translation between models will be required.
- Each org will try to converge on common representation formats and definitions.
- Co-operation and broad awareness needed in the relevant organisations.
- A global market needs global solutions.





# Links

- Workshop site

<http://iab.org/activities/workshops/iotsi/>

- Report (work in progress)

<https://tools.ietf.org/html/draft-iab-iotsi-workshop-00>

- CoRE

<https://tools.ietf.org/wg/core/>

# Thank You



[jaime.jimenez@ericsson.com](mailto:jaime.jimenez@ericsson.com)  @jaim <http://jaimejim.github.io>